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The Relationship between Self-rated Health and Hospital Records

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Abstract

This paper investigates whether self-rated health (SRH) co-varies with individual hospital records. By linking the Danish Longitudinal Survey on Aging with individual hospital records covering all hospital admissions from 1995-2006, I show that SRH is correlated to historical, current, and future hospital records. I use both measures separately to control for health in a regression of mortality on wealth. Using only historical and current hospitalization controls for health yields the common result, that SRH is a stronger predictor of mortality than objective health measures. The addition of future hospitalizations as controls shows that the estimated gradient on wealth is similar to one in which SRH is the control. The results suggest that SRH is able to capture diseases at prodromal stages and that with a sufficiently long time series of individual records, objective health measures can predict mortality to the same extent as global self-rated measures.

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1 Introduction

The vast majority of micro-studies within health economics rely on survey data, and the self-rated health (SRH) question "How do you rate your health in general?" is widely used. The Health and Retirement Study (HRS), Survey of Health, Ageing and Retirement in Europe (SHARE), and English Longitudinal Study of Ageing (ELSA), the major socioeconomic surveys for senior citizens for the U.S., Europe, and England, are among the many surveys that collect this question. A growing literature is concerned about the answers being biased, as this could lead to misleading results. For example, the estimated magnitude of the economic gradient in health, which has attracted both political and academic attention, depends crucially on the health measure applied—SRH has been shown to be a stronger predictor than more objective health measures[1] (Mossey and Shapiro, 1982; Idler and Benyamini, 1997; Currie and Madrian, 1999). Although this result could reflect biased answers to the SRH question, little is known about what underlies the discrepancy between subjective and objective health measures.

By mapping SRH and other measures, the literature has sought to validate SRH. For example, Dwyer and Mitchell (1999) and Juerges (2007) show that SRH correlates with more objective measures of health *within* cross-sectional surveys. Crossley and Kennedy (2002) exploits that some individuals answered the same SRH question twice but in *different settings* and show that the assessments are sensitive to age, income and occupation, as well as the survey design. To anchor the assessment of own health Bago D'uva et al. (2008) and Mu (2013) use vignettes revealing the interviewee's ratings of others health in hypothetical situations.[2] These kinds of validation studies are valuable since they inform about potential measurement errors in SRH. However, since they in any case rely on subjective assessments from the *same* individual, measurement errors related to (unobserved) person specific characteristics are not necessarily resolved. This is critical in the

[1]The term "more objective measures" refers to self-reports of specific health limitations, e.g., functional limitation, chronic physical and mental disorders, and acute illnesses, Dwyer and Mitchell (1999).

[2]Although state-of-the-art vignette methods neatly circumvent problems of "response style", the approach rely on the assumption that individuals rate the vignettes in the same way as their own.

presence of non-random reporting biases such as the justification bias (Currie and Madrian, 1999).

Instead of validating SRH using multiple measures reported by the same person, I extend the existing literature by combining survey answers with longitudinal administrative hospitalization data[3] of the full population recorded five years around the survey. The advantages of this approach are three-fold: the administrative data are objective third-party reports, the high frequency of the administrative data allows me to assess the relationship between the timing of the objective measure and the subjective SRH, and the representativeness of the survey is directly testable. Specifically, this paper assesses the extent to which SRH co-varies with individual hospitalizations observed in the survey year and two years before and after it. After having verified that the two measures correlate, I apply both measures to the estimation of the wealth-mortality gradient similar to Attanasio and Emmerson (2003) who show that omitting health conditions in wealth-mortality analyses leads to biased estimations of the economic gradient in mortality. Carrying out such a test requires population representative survey data and high quality third-party reports in the same data set. Such data are available for research purposes in Denmark. I use SRH from the Danish Longitudinal Study of Ageing (DLSA)—a pool of the approximately 14,000 individuals aged 52 and older interviewed in 1997 and 2002—matched directly to administrative hospitalization data covering all admissions from both public, and private hospital records from in- and outpatients, and patients from emergency units.

The results suggest that historical, current, and future hospitalizations are correlated with SRH. Moreover, regression analyses of mortality on wealth using control variables of health deduced from historical, current, and future hospital records produce nearly identical results as estimations that use SRH. However, if the estimation omits future hospital records, i.e., only hospitalizations from the current and the historical periods control for health, then SRH is a stronger predictor for mortality than objective health measures—an oftentimes found result (Currie and Madrian, 1999)

[3]Baker et al. (2004) also match survey responses and adminstrative data. They focus on self-reports of chronic diseases—not global self-rated health—and find dicrepancies between diagnoses from hospitalization records and self-reports.

that has been interpreted in many different ways (Idler and Benyamini, 1997). In line with previous findings, my results also suggest that subjective health measures contain more information than a past hospitalization history can predict. More important, this additional information is correlated with future objective health variables. This study thus contributes to the literature by showing that the discrepancy between subjective and objective health measures is not driven by justification bias, but rather an inability of lagged objective measures to capture diseases at prodromal stages, i.e., foreseeable future health outcomes.

2 Validating SRH using hospital records

No consensus in the literature exists on which empirical measures capture what we call "health." Currie and Madrian (1999) neatly pinpoint this problem: "The concept of 'health' is similar to the concept of 'ability' in that while everyone has an idea of what is meant by the term, it is extremely difficult to measure." Following Grossman (1972) I consider health as an individual human capital stock variable. But finding empirical proxies for it is not straightforward. Wagstaff (2002) argues that the health stock is inherently unobserved, but overcome this by applying the latent variable Multiple Indicator Multiple Cause (MIMIC) approach. Grossman (2000) suggests that the *stock* of health is measured by SRH. However, this measure is potentially flawed by justification or state-dependence biases (Currie and Madrian, 1999; Kerkhofs and Lindeboom, 2002). A third-party reported hospitalization does not suffer from such bias, but might capture another derivative of the human capital stock model, e.g., a hospitalization is both an *investment* to health and an *outcome* variable.

In Grossman (2000)'s definition health evolves in the following way:

$$H_{t+1} = I_t + (1 - \delta) H_t \tag{1}$$

H_t is the current stock of health, I_t gross-investments in health, (e.g., exercise, diet and medical consumption), and δ is the rate of depreciation. Because people eventually die, the long-run evolvement of health is bound to decrease according to a persistent process. Whereas the long-run evolvement is deterministically downward sloping, the short run evolvement of health can go in either direction and persist with varying intensity, e.g., the occurrence of chronic disease keeps the health stock permanently low, whereas a more easily curable disease only affects it temporarily.

The literature has used many empirical measures for H_t. Currie and Madrian (1999) summarize eight health measures typically applied for regressing an outcome on health: self-rated health, indicator of limitations to work, functional limitations, the presence of chronic and acute conditions, the use of medical care, clinical assessments of mental illnesses or alcoholism, nutritional status, and expected or future mortality. They generally find that analyses using different measures of health qualitatively point in the same direction, but the magnitudes of the effects are very sensitive to the applied measures. Specifically, studies using SRH are more likely to find larger and more significant effects on, say, mortality than studies using other more objective empirical health variables. This could reflect that respondents answer the survey questions according to their subjective understandings of the term "health" (Krause and Jay, 1994). Consequently, SRH does not necessarily measure the health stock only.

Several studies have assessed the validity of SRH. By comparing subjective and more objective measures of health in the HRS, Dwyer and Mitchell (1999) provide evidence of only little measurement error in SRH, suggesting only modest justification bias in the effects of health on retirement decisions. However, the more objective measures within the HRS[4] are all first-party reports, leading to a potential correlation between the measurement error of the subjective and more objective measures. The same problem persists in Crossley and Kennedy (2002); van Dooerslaer and Jones (2003); Juerges (2007) and the justification bias is not necessarily eliminated. Menec and Chipperfield (2001) circumvent this problem by combining subjective health measures in a survey among the elderly in Manitoba, Canada, with hospital records. In line with the current paper's validation

[4]Dwyer and Mitchell (1999) count the number of health conditions that the respondent reports.

strategy, the advantage of the Manitoba data is that hospital records are third-party reports, and the measurement errors are therefore orthogonal to the measurement error in the subjective health assessment. Menec and Chipperfield (2001), even after controlling for objective health measures in the interview year, show that SRH predicts mortality and hospital admissions in the following calendar year. They conclude that SRH captures more than what hospital records can reveal and therefore lead to the possibility of a justification bias.

However, validating SRH from hospital admissions raises the concern that admissions data capture health events, i.e., changes in health—not the health stock. Nevertheless, given an underlying heterogeneity in health between individuals, and given that particularly unhealthy individuals are more likely to experience hospitalizations more frequently and for longer duration, then information from hospital records measured in a *sufficiently long period* will capture the heterogeneity rather than merely a derivative of the health stock. Consequently, the relatively limited period of hospitalization measures available in Menec and Chipperfield (2001) (hospital records in the interview year only) can explain the hospital record's failure to predict SRH—longer time series are needed. This point is crucial for understanding what kind of information SRH contains—if a hospitalization is triggered when the health stock meets a certain threshold and the depreciation of the health stock happens continuously, people might be able to anticipate a hospitalization, e.g., if symptoms are only prodromal. In such a case, current SRH would correlate with future hospitalizations. The health profile figure 1 graphically illustrates the point. The thin solid line reflects the long-run evolution of an individual's health stock. The thick solid line reflects the actual evolution, such that the dip captures a transitory health shock. The dashed horizontal line marks a threshold that triggers a hospitalization. Historical hospital records will not be able to capture the true latent health in the area between the two vertical dashed lines, in which the actual and the deterministic health levels differ prior to the hospital admission, reflecting that a disease is at a prodromal stage. Consequently, using only past hospital records, not later, for health at a given time potentially underestimates true health.

[Figure 1 about here]

3 Data

The data is survey answers and administrative data linked to one-another via a unique personal identification number (CPR). All Danish residents are assigned a CPR that all government institutions use for citizen-specific information. In health service provision, not only public but also private institutions use the CPR for administrative purposes. The National Board of Health, a central government institution under the Danish Ministry of Health, collects data from both private and public health service providers and stores it at Statistics Denmark in central confidential registers covering the entire Danish population. These health registers can be merged to other government registers, and to surveys that use the CPR. Under strict security provisions, researchers working at authorized Danish research institutions can obtain access to the register data at Statistics Denmark. This study combines two health registers and one survey carried out among Danish residents.[5]

3.1 Survey data

The Danish Longitudinal Study of Ageing (DLSA) is a survey carried out on a representative sample[6] of Danish residents aged 52 and above. In 1997 the DLSA interviewed Danish citizens born in every fifth birth cohort from 1920 to 1945. These citizens were re-interviewed in 2002 and 2007. Because I link the DLSA to register data available from 1995 through 2006, I use only the first two waves of the survey. The 1950 cohort was added to the survey in the 2002 wave.[7] By pooling data from the two waves, I end up with 14,071 observations (5,864 from 1997 and 8,207 from 2002).

[5] The data source is identical to that used by Gupta and Larsen (2010).

[6] 3.8% of the population with a take-up rate of 70.1%. The survey is available via Centre for Survey and Survey/register data, http://www.sfi.dk/cssr-7745.aspx.

[7] Furthermore, to keep cross-sectional representation due to deaths and attrition, the 2002 wave adds new individuals from the 1920-45 cohorts

Through the fourth quarter of the interview year, the interviewers conducted face-to-face surveys. The survey collects information about demographics, labor market attachment, living and economic conditions, family relations, and health. This study focuses on the survey's question about global SRH[8]: "How do you assess your current health overall?" (author's translation). The respondent is given five possible answers: "Very good," "good," "fair," "poor," or "very poor"[9]. In the first two waves, a total of 27 observations had missing answers to this question. These observations are dropped from the analysis. To make the analysis comparable to register data measured through a full calendar year, I dropped 36 observations of individuals who died after being interviewed but during that same year.

[Table I about here]

Table I describes the distribution of the SRH measure by gender and age. Each cell of the table reports the fraction, the (binomial) standard error and the frequency of a given gender and age group's answers. The bottom row ("Total") shows the averages across all age groups. This row reveals two characteristics of SRH distributions: Men report better health than women, and the SRH distribution is skewed towards good health. Few individuals report very poor or poor health (7.6% of the men and 9.1% of the women), and many report good or very good health (71.4% of the men and 66.1% of the women). Moreover, in line with the long-run prediction of the evolvement health, Table I shows the distribution moves to the left—towards poor and very poor health—as age increases, e.g., the probability of reporting good or very good health is 79.0% for 52 year-old men and 56.5% for a 82 year-old men[10].

[8]The question is the first of many about health.

[9]Other surveys containing information about the elderly ask similar questions (e.g., HRS, SHARE and ELSA). The English wording in these surveys is, "Would you say your health is excellent, very good, good, fair, or poor?"

[10]The distributional characteristics of SRH are similar to those in SHARE (see e.g., Juerges (2007))

3.2 Administrative Health Data

The administrative data contains individual records from the Danish Public Health Insurance program, a universal government health program covering all residents in Denmark. It provides free access to hospital services for all residents and The National Board of Health gathers administrative health data within the program. For all individuals older than 44, I have access to two registers: the Death Register containing death causes and dates and the National Patient Register containing hospitalization records. The Death Register contains information about the date and the cause of death through 2008.

The National Patient Register includes hospitalization records from 1980-2006 for all public and private hospitals. These records include admission dates and duration in days, ICD8 diagnoses (through 1993) and ICD10 diagnoses (from 1994 onwards) and patient types (i.e., inpatients, outpatients and emergency unit patients). From 1995 all three patient types are registered. When combining this data with the survey, I can exploit information from the National Patient Register consistently for all types of patient two years before and two years after the interview.

I construct two general measures of health: a five-year survival probability, which I use in section 5 to test the second measure, that counts all hospital days during a calender year. Panel A of Table II describes these two health measures for all age groups in DLSA, reported separately for men and women through two calendar years: the interview year (t=0) and the year before (t=-1). Furthermore, to check the representativeness of the DLSA, I compare the descriptives with a sample of the full population (FULL). This reference group contains the full population that the DLSA samples, i.e., all individuals in every fifth cohort from 1920-1945 still living on December 31 1997, and all individuals in the 1920-1950 cohorts still living in 2002.

[Table II about here]

In the survey sample (DLSA), the five-year survival probability is 88.8% for the men and 91.4% for the women in the interview year. For both genders, these rates are slightly higher, but only borderline different from the comparable FULL in the interview year. A cross-time comparison of the survival rates shows lower rates in t=0 than in t=-1. This is not only the result of increasing mortality rates when the respondents grow older but also an artifact from the sample selection—only people alive on December 31 of the interview year are sampled. Therefore, we know that the subjects survived the first year from t=-1 to t=0. Consequently, the survival probability reported in t=-1 precisely measures a four-year survival probability from t=0. Because the table shows only a borderline difference for the women in the five-year survival probability but no significant difference between the comparison groups for both of the genders in four-year survival, the survey is arguably representative of survival rates.

The objective health measure from the National Patient Register, hospital duration, is best described as truncated distribution—for both genders, about 30% of the observed groups have at least one hospital record in the interview year. This truncation causes large standard errors of simple mean calculations. Consequently, concluding anything about the representativeness of the survey on the sole basis of means and standard errors is misleading, as no mean would be tested differently from zero. Therefore, I also compare percentiles for the National Patient Register variables. Although the women tend to report worse health than the men on SRH, Table II shows no striking differences between the genders for the National Patient register variable, i.e., women and men are hospitalized to the same extent (about 2.5 days in the interview year). Regardless of gender, sample, or time, those at the 75th percentile experience one hospital day. In the top 1% of the distribution, the selections range from about 40 hospital days to a full year. In all, the distributions of hospital records for both genders are fairly similar in both the DLSA and the FULL samples.

Panel B shows distributional features of the hospital durations of the oldest subjects, those aged 67 and older. All statistics for the elderly, except for the maximum value in t-1 for both genders, are weakly larger than those for the population of all ages, i.e., older individuals tend to spend more time in hospitals. Like the SRH measure, the measure deduced from the hospital records captures the long-run attribute of the latent health variable, showing that health generally deteriorates with age.

Together, the register-based health measures have similar distributional characteristics for both the DLSA and FULL, suggesting that the DLSA is representative for the population as a whole. That women tend to report worse SRH than men is well-known in the literature (Case and Paxson, 2005) but remains a paradox, given that women have higher survival probabilities than men, while using hospitals to the same extent. Therefore, I conduct separate analyses for men and women in the remainder of the paper.

4 The correlation between SRH and hospital days

This section explores whether the number of hospital days correlates with SRH. To circumvent the truncation problem of the hospitalization measure, I divide the population into groups defined by the number of hospital days through the interview year (Table III): no records, 1-2 days, 3-4 days, 5-7 days, 8-14 days, or 15-365 days.
[Table III about here]

The first column of Table III shows men's mean SRH score, in which "very poor" is rated 1 and "very good" is rated 5 (standard deviations in parentheses). The second column shows the probability of reporting "good" or "very good" (binary standard errors in parentheses). The third column shows the fraction of the DLSA in each of the six hospitalization groups, and the fourth column shows the fraction in the FULL. Columns 5-8 show the figures for the women. Columns 3-4 and 7-8 show no significant differences between the samples (within the genders), showing that the DLSA is representative for the full population. Columns 1-2 and 5-6 show that for both genders the more hospital days recorded for the individual, the worse health he or she reports. In line with Menec and Chipperfield (2001), I find that SRH contains information about hospitalization in the interview year. Nonetheless, women tend to report worse health than men.

Next I extend the existing literature by investigating the relationship between SRH and current, lagged, and future hospitalization in a multivariate setting. Table IV shows OLS[11] regressions of subjective health on current, one-to-two-year lagged and one-to-two-year future hospitalizations. Hospitalization is measured by dummy variables, taking the value one if at least one hospitalization has occurred, and by count variables giving the number of hospital days in each year and the square of the number of hospital days. Columns (1)-(4) present results for men, and columns (5)-(8) present results for women.

[Table IV about here]

The results in the first column, including only current year hospitalization, show that current hospitalization is correlated with subjective health. Both the dummy indicator and the count variables are significant, confirming the expectation that hospitalization is negatively associated with SRH. Column (2) includes lagged hospitalizations, and both current and lagged hospitalizations are highly significant. This finding suggests that subjective health captures not only transitory variations in health but also more persistent differences in health across people. In Column (3), which includes one-period-ahead hospitalization, the dummy indicator—the linear, but not the squared count measure—is significant. That future hospitalization is correlated with current subjective health is consistent with the observation that health evolves according to a persistent process and that hospitalization takes place only when health reaches a threshold. In contrast, subjective health captures changes at a higher level of detail. Column (4), which also includes hospitalization in year two after the interview, shows that the sample shrinks because some respondents die. Results for this slightly reduced sample suggest that hospitalization two years after the interview is also correlated with subjective health.

[11] I also estimate the models using an ordered probit estimator treating SRH as an ordinal measure. These estimates (Table VI) exhibit the same pattern as the OLS estimates.

Results are qualitatively similar for women. Both current, lagged, and future hospitalization are significantly correlated with subjective health. The estimated parameters for the event of being hospitalized tend to be (numerically) larger for women than for men, differences that are often significant. This finding suggests that hospitalization triggers a greater adjustment in subjective health for women.

5 The economic gradient in mortality—controlling for health

Thus far this study has shown that SRH co-varies with hospitalizations observed both before and after the self-rated assessment of health took place. To investigate whether the use of hospital records, instead of SRH, to control for initial health affects the result, this section applies the health measures in a regression model of mortality on wealth. Estimating this economic gradient in mortality has been the focal point of a large body of literature within economics, public health, and social medicine [12]. Much of the literature uses annual income to estimate the economic gradient in mortality. As annual income is potentially affected by a transitory element (Meghir and Pistaferri, 2010) potentially caused by health shocks, the estimation of the economic gradient in mortality is likely to be mismeasured.

One can circumvent this problem by estimating the economic gradient from wealth and control for health conditions (Attanasio and Emmerson, 2003). As opposed to current income, wealth is likely to reflect a measure of available life-cycle resources. However, given that health conditions determine both wealth and mortality, people in bad health might accumulate less wealth due to a shorter life horizon. In that case, if health conditions are omitted as controls, the mortality gradient is overestimated. Empirically, Hurd et al. (1999) show that the economic gradient in mortality in the U.S. vanish once they control for initial health conditions (and a subjective probability assess-

[12] see Hoffmann 2011; Broennum-Hansen and Baadsgaard 2008; Cutler et al. 2006; Eibner and Evans 2005; Baker et al. 2004; Gerdtham and Johannesson 2004; Marmot 2002; Wagstaff and van Doorslaer 2000; Deaton and Paxson 1999; Senn et al. 1998; Wilkinson 1997, 1996

ment of survival). Attanasio and Emmerson (2003) show for the UK that, even after controlling for initial health, the wealth gradient in mortality persists.

When estimating the economic gradient from wealth, Attanasio and Hoynes (2000) emphasize the problem of comparing wealth levels across age-groups: In a simple life-cycle framework, people accumulate wealth, which peaks just before retirement; thereafter, persons who expect to live longer decumulate wealth more slowly than people with a shorter life expectancy. Because people close to retirement are consequently wealthier than both older or younger cohorts, comparing wealth across age groups in a mortality analysis is potentially misleading. However, under the assumption that people keep their relative position in the wealth distribution within their cohort over time, the wealth rank within cohorts is potentially more appropriate for estimating the economic gradient from wealth than the level of wealth itself. To estimate the economic gradient in mortality, I use household equivalized[13] financial and housing wealth rank within a cohort in the model in Attanasio and Emmerson (2003). This section investigates how the estimation of the relation between survival and wealth is affected by the use of different measures of health. I estimate the following reduced form model for each of the genders

$$s_i = \alpha + \beta y_i + \delta h_i + \eta e_i + \theta c_i + \gamma_1 a_i + \gamma_2 a_i^2 + \varepsilon_i \tag{2}$$

s_i indicates if individual i survives five years. Survival is determined by the wealth rank (financial and housing wealth) within a birth cohort in the end of the interview year, y_i; initial health, h_i; education (dummies for low, intermediate or high education), e_i; civil status in the interview year, c_i; age, a_i; age squared, a_i^2 , and the error term, ε_i. The parameter of interest is β, estimating the economic gradient in mortality. I explore how β varies by using different specifications of h_i. I estimate linear probability models, allowing me to interpret the parameter estimates as marginal effects [14].

[13] I add spousal wealth and use a standard McClements equivalizing scale, to divide singles' wealth by .61 to make it comparable to the household wealth of couples.

[14] In the appendix I report similar estimates from a probit model (Tables IX and X).

Table V reports the estimation results for men (panel A) and women (panel B) separately[15]. The first column presents the estimates of a base-line model in which no controls for health are included. The parameter estimate of the wealth rank is 0.080 (0.075) for the men (women), suggesting that the difference in the survival probability from the bottom to the top of the wealth distribution is about 8 percentage points.

[Table V about here]

The second column controls for SRH, which leads to a decrease in the wealth gradient to 5.1% (4.2%) for the men (women). The statistics at the bottom of the table are from a test of the null hypothesis that the parameter estimate of the wealth rank is equal to the corresponding parameter estimate in the base-line regression ($H_0 : \beta_{NoHealth} = \beta_{SRH}$, $H_1 : \beta_{NoHealth} > \beta_{SRH}$). The very bottom line reports the p-value of a one-sided test. The null is rejected, i.e., the parameter estimate of the wealth rank in the model controlling for SRH is significantly lower than in the model that does not include any health controls. Thus the omission of health leads to an overestimation of the wealth gradient.

Columns 3-6 explore how the estimated wealth gradient changes when I apply the measures deduced from hospital records. Column 3 includes hospital records (a dummy for having at least one hospital record, and the count variables of hospital days) from the current year, t (the year health was self-assessed in the survey). The parameter estimate of the wealth rank is 0.071 (0.065) for both men (women). Although the parameter estimates are lower than in the models without health controls, I cannot reject the null-hypothesis that parameter estimates are equal.

Column 4 adds the historical hospital records to the estimation model. Although the parameter estimates of wealth decrease, the estimates are still not tested differently from the baseline models. When the hospital records from t+1 are included, the parameter estimate is different from the

[15] In the appendix, Tables VII and VIII report the full set of parameter estimates.

baseline at the 10% level. When I then include records from t+2, the parameter estimate is not only different from the baseline model, but the magnitudes of parameter estimates of the wealth gradient are also similar to those estimated via SRH. Thus the SRH measure and the health measure that uses both historical, current, and future hospital records correct the estimation of the economic gradient in mortality to the same extent.

Overall, relative to the models using SRH as a control for health, the gradient in mortality remain high in models that only include hospital records from the current and the lagged periods. This result verifies the results previously found in the literature, that SRH is a stronger predictor of mortality than objective measures. However, once I include future hospitalizations in the regressions, the gradient is estimated at the same magnitude as the models using SRH. Thus the two different measures of health provide the same result, leaving no room for justification biases in the SRH measure.

6 Conclusion

This study explores the correlation (measured at the individual level) between SRH from the population representative survey the Danish Longitudinal Study of Aging in 1997 and 2002 and third-party-reported hospital records from all Danish public and private hospitals from 1995-2006. I show that SRH correlates with not only historical and current, but also future hospitalizations, suggesting that SRH is able to capture diseases at prodromal stages. In addition, women on average report worse health than men and the correlation between SRH and hospitalization is generally stronger for women.

I apply the hospitalization measures in a regression analysis of mortality on wealth. When I use hospital records from the current and the historical periods only, I reproduce the results previously shown in the literature, that SRH is a stronger predictor for mortality than objective health measures. However, using lagged, current, and future hospitalization, I obtain almost identical results whether I use SRH or health deduced from hospital records. This result suggests that objective health measures can predict mortality to the same extent as global self-rated measures. Therefore, justification bias does not severely affect global SRH assessments. The discrepancy between subjective and objective measures of health is driven by an inability of historical objective measures to predict health outcomes foreseeable for the individual.

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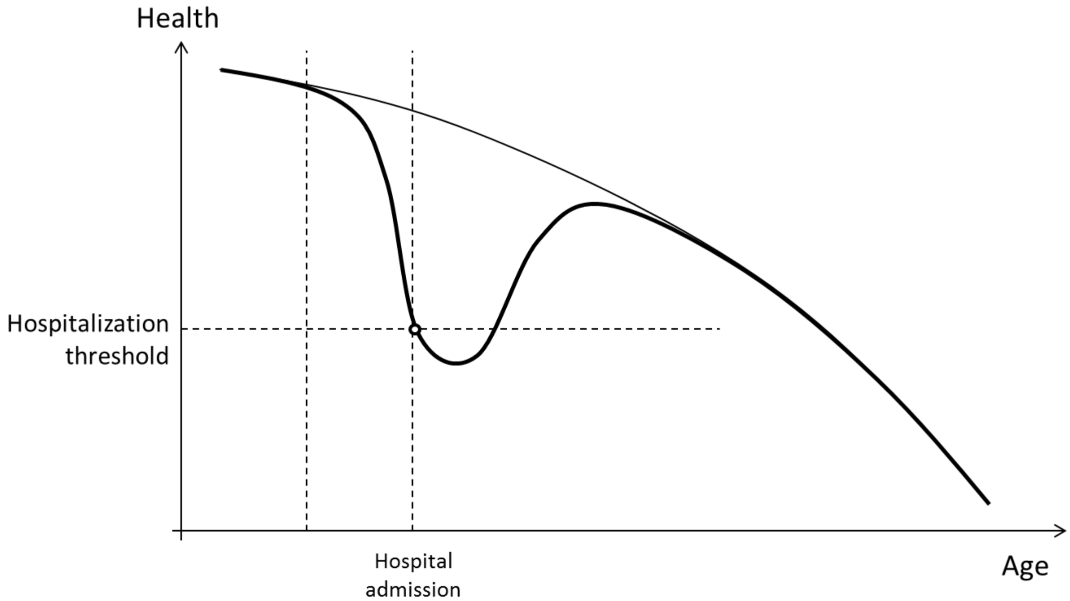
Figures

Figure 1: Health Profile



Notes: Figure 1 illustrates the importance of the timing of the a hospitalization for the self-reported health assessment. The thin solid line reflects the long-run evolution of an individual's health stock. The thick solid line reflects the actual evolution, such that the dip captures a transitory health shock. The dashed horizontal line marks a threshold that triggers a hospitalization. Historical hospital records will not be able to capture the true latent health in the area between the two vertical dashed lines, in which the actual and the long-run health evolvement differ prior to the hospital admission. This could be the case if a sickness is at a prodomal stage. Self-rated health will capture true latent health in this case; historical hospital records will not.

Tables

Table I: Distribution of self-rated health.

Age	MEN					WOMEN				
	Very poor (1)	Poor (2)	Fair (3)	Good (4)	Very good (5)	Very poor (6)	Poor (7)	Fair (8)	Good (9)	Very good (10)
52	0.017	0.041	0.152	0.373	0.417	0.022	0.044	0.204	0.359	0.370
	(0.003)	(0.005)	(0.009)	(0.012)	(0.013)	(0.004)	(0.005)	(0.010)	(0.012)	(0.012)
	[26]	[63]	[234]	[574]	[641]	[35]	[71]	[327]	[576]	[595]
57	0.020	0.060	0.187	0.377	0.355	0.019	0.065	0.223	0.377	0.316
	(0.004)	(0.006)	(0.010)	(0.013)	(0.012)	(0.004)	(0.006)	(0.011)	(0.013)	(0.012)
	[29]	[88]	[275]	[555]	[523]	[28]	[96]	[331]	[559]	[468]
62	0.015	0.041	0.195	0.414	0.335	0.018	0.056	0.234	0.403	0.287
	(0.004)	(0.006)	(0.012)	(0.015)	(0.014)	(0.004)	(0.007)	(0.012)	(0.014)	(0.013)
	[16]	[45]	[214]	[454]	[368]	[21]	[65]	[270]	[465]	[331]
67	0.022	0.054	0.220	0.423	0.281	0.030	0.053	0.252	0.379	0.285
	(0.005)	(0.007)	(0.013)	(0.016)	(0.014)	(0.005)	(0.007)	(0.014)	(0.015)	(0.014)
	[21]	[52]	[213]	[410]	[272]	[30]	[53]	[252]	[379]	[285]
72	0.021	0.071	0.276	0.395	0.235	0.043	0.078	0.261	0.368	0.245
	(0.005)	(0.009)	(0.016)	(0.018)	(0.015)	(0.007)	(0.009)	(0.015)	(0.016)	(0.014)
	[16]	[55]	[214]	[306]	[182]	[39]	[70]	[235]	[331]	[220]
77	0.041	0.077	0.283	0.391	0.206	0.034	0.106	0.326	0.362	0.170
	(0.008)	(0.011)	(0.018)	(0.019)	(0.016)	(0.006)	(0.011)	(0.016)	(0.017)	(0.013)
	[26]	[49]	[180]	[248]	[131]	[28]	[88]	[270]	[299]	[141]
82	0.039	0.082	0.310	0.397	0.168	0.032	0.087	0.334	0.397	0.137
	(0.013)	(0.018)	(0.030)	(0.032)	(0.025)	(0.009)	(0.014)	(0.024)	(0.025)	(0.018)
	[9]	[19]	[72]	[92]	[39]	[12]	[33]	[127]	[151]	[52]
Total	0.021	0.055	0.209	0.393	0.321	0.026	0.065	0.247	0.376	0.285
	(0.002)	(0.003)	(0.005)	(0.006)	(0.006)	(0.002)	(0.003)	(0.005)	(0.006)	(0.005)
	[143]	[371]	[1402]	[2639]	[2156]	[193]	[476]	[1812]	[2760]	[2092]

Fraction of groups by gender and age reporting a given health by answering the following question: "How do you assess your current health overall?" (author's translation). Answers from the 1997- and 2002-waves of Danish Longitudinal Study of Ageing (DLSA) are pooled and individuals with missing self-rated health reports or people dying later in the interview year are dropped. Binomial standard errors of the fractions in parentheses and frequencies in brackets. Columns (1)-(5) reports these statistics for the men and columns (6)-(10) similar statistics for the women.

Table II: Distributions of survival probabilities and hospitalization measures.

	MEN				WOMEN			
	t		t-1		t		t-1	
	DLSA (1)	FULL (2)	DLSA (3)	FULL (4)	DLSA (5)	FULL (6)	DLSA (7)	FULL (8)
PANEL A: ALL AGES, 52-82								
Survival probability	0.888	0.878	0.910	0.904	0.914	0.904	0.934	0.925
	(0.004)	(0.001)	(0.004)	(0.001)	(0.003)	(0.000)	(0.003)	(0.000)
Hospital days (mean)	2.510	2.725	2.268	2.274	2.495	2.625	2.093	2.297
	(11.202)	(11.302)	(8.944)	(9.483)	(9.413)	(10.248)	(7.881)	(9.186)
Median	0	0	0	0	0	0	0	0
75th percentile	1	1	1	1	1	1	1	1
99th percentile	42	47	39	40	40	44	36	39
Max	365	365	264	366	365	365	183	366
N	6689	323365	6689	323365	7319	351972	7319	351972
PANEL B: AGES 67-82								
Hospital days (mean)	3.882	4.123	3.326	3.343	3.554	3.769	2.830	3.185
	(15.697)	(13.981)	(10.676)	(11.572)	(11.810)	(12.422)	(9.390)	(11.011)
Median	0	0	0	0	0	0	0	0
75th percentile	2	2	2	2	2	2	1	1
99th percentile	48	61	50	52	46	57	43	50
Max	365	365	219	366	365	365	174	366
N	2586	117839	2586	117839	3086	148324	3086	148324

Panel A reports the distributions of survival probabilities and hospital days for individuals born in every fifth age group from 52 through 82. Panel B reports these statistics for those aged 67 and above. Columns (1)-(4) reports the statistics for the men and columns (6)-(10) for the women. Columns (1),(2),(5), and (6) report statistics for the interview year, t. Note that the survival probabilities in these columns measure the probabilities of surviving five years from the interview. Columns (3),(4),(7), and (8) report statistics for samples one year prior the interview, t-1. The survival probabilities in these columns measure the probabilities of surviving four years from the interview. Columns (1), (3), (5), and (7), i.e., columns with the caption "DLSA", refer to the sample of individuals in the Danish Longitudinal Survey of Ageing. Columns (2), (4), (6), and (8), i.e., columns with the caption "FULL", refer to the comparable sample from the full population. Binomial standard errors in parentheses for the survival probabilities and simple standard errors for the hospital days.

Table III: Hospital durations versus self-rated health in the interview year.

	MEN				WOMEN			
	Self-rated health		Share of sample		Self-rated health		Share of sample	
Hospitalization bins	Mean (1-5) (1)	Good/ very good (2)	DLSA (3)	FULL (4)	Mean (1-5) (5)	Good/ very good (6)	DLSA (7)	FULL (8)
Zero hospital days	4.086	0.773	0.708	0.706	3.993	0.727	0.699	0.703
	(0.877)	(0.006)	(0.006)	(0.001)	(0.920)	(0.006)	(0.005)	(0.001)
1-2 hospital days	3.846	0.688	0.135	0.129	3.718	0.612	0.132	0.129
	(1.005)	(0.015)	(0.004)	(0.001)	(1.005)	(0.016)	(0.004)	(0.001)
3-4 hospital days	3.736	0.624	0.044	0.046	3.564	0.558	0.047	0.047
	(1.002)	(0.028)	(0.003)	(0.000)	(1.019)	(0.027)	(0.002)	(0.000)
5-7 hospital days	3.510	0.571	0.031	0.033	3.382	0.481	0.036	0.036
	(1.086)	(0.034)	(0.002)	(0.000)	(1.017)	(0.031)	(0.002)	(0.000)
8-14 hospital days	3.407	0.468	0.037	0.037	3.277	0.452	0.040	0.038
	(0.981)	(0.032)	(0.002)	(0.000)	(1.043)	(0.029)	(0.002)	(0.000)
15-365 hospital days	2.904	0.295	0.045	0.048	2.845	0.264	0.047	0.047
	(1.112)	(0.026)	(0.003)	(0.000)	(1.067)	(0.024)	(0.002)	(0.000)
N			6689	323365			7319	351972

The rows bin individuals by the number of days they spent in the hospital during the interview year. Columns (1)-(4) show statistics for the men and columns (5)-(8) statistics for the women. Columns (1) and (5) reports the average health report in each of the bins where 1 is very poor and 5 is very good. Columns (2) and (6) show the fraction in each bin reporting good or very good health. Columns (3) and (7) report the share of the individuals of the DLSA in each of the hospitalization bins. Columns (4) and (8) report the share in each bin for the comparable sample. Standard deviations in parentheses.

Table IV: Self-rated health vs. hospital days, OLS.

	Men				Women			
Successively adding:	t (1)	t-2 & t-1 (2)	t+1 (3)	t+2[a] (4)	t (5)	t-2 & t-1 (6)	t+1 (7)	t+2[a] (8)
Hospitalized (t-2)		-.179***	-.159***	-.147***		-.233***	-.213***	-.200***
		(.031)	(.031)	(.031)		(.032)	(.032)	(.032)
Hospitalized (t-1)		-.160***	-.137***	-.128***		-.173***	-.158***	-.151***
		(.031)	(.031)	(.031)		(.030)	(.030)	(.030)
Hospitalized (t)	-.276***	-.171***	-.142***	-.117***	-.335***	-.241***	-.208***	-.194***
	(.031)	(.031)	(.030)	(.030)	(.030)	(.029)	(.029)	(.029)
Hospitalized (t+1)			-.134***	-.089**			-.125***	-.098***
			(.030)	(.030)			(.028)	(.029)
Hospitalized (t+2)				-.137***				-.100***
				(.028)				(.027)
Hospital days (t-2)		-.011***	-.010***	-9.5e-03***		-.017***	-.014***	-.013***
		(2.3e-03)	(2.4e-03)	(2.4e-03)		(3.4e-03)	(3.4e-03)	(3.4e-03)
Hospital days sq. (t-2)		4.3e-05***	4.2e-05***	3.9e-05***		8.8e-05*	6.9e-05*	6.5e-05*
		(9.7e-06)	(1.0e-05)	(1.1e-05)		(3.4e-05)	(3.4e-05)	(3.3e-05)
Hospital days (t-1)		-.021***	-.019***	-.018***		-.014***	-.013***	-.013***
		(2.8e-03)	(2.7e-03)	(2.8e-03)		(3.3e-03)	(3.4e-03)	(3.4e-03)
Hospital days sq. (t-1)		1.1e-04***	1.1e-04***	9.9e-05***		7.1e-05	6.2e-05	5.3e-05
		(2.1e-05)	(2.0e-05)	(2.0e-05)		(3.8e-05)	(4.1e-05)	(4.1e-05)
Hospital days (t)	-.029***	-.025***	-.021***	-.02***	-.027***	-.021***	-.019***	-.017***
	(2.4e-03)	(2.5e-03)	(2.5e-03)	(2.4e-03)	(2.4e-03)	(2.2e-03)	(2.2e-03)	(2.2e-03)
Hospital days sq. (t)	7.9e-05***	7.1e-05***	6.7e-05***	6.2e-05***	7.1e-05***	6.1e-05***	5.7e-05***	5.1e-05***
	(7.2e-06)	(7.0e-06)	(7.2e-06)	(7.2e-06)	(1.3e-05)	(1.1e-05)	(1.1e-05)	(9.3e-06)
Hospital days (t+1)			-.011***	-.010***			-.015***	-.013***
			(2.3e-03)	(2.5e-03)			(2.3e-03)	(2.4e-03)
Hospital days sq. (t+1)			3.5e-05	3.3e-05			9.4e-05***	8.0e-05***
			(2.0e-05)	(2.1e-05)			(1.4e-05)	(1.3e-05)
Hospital days (t+2)				-4.5e-03*				-9.0e-03***
				(2.0e-03)				(2.0e-03)
Hospital days sq. (t+2)				2.0e-05				4.3e-05***
				(1.4e-05)				(9.7e-06)
constant	4.09***	4.19***	4.23***	4.26***	3.99***	4.12***	4.16***	4.19***
	(.013)	(.014)	(.014)	(.015)	(.013)	(.014)	(.015)	(.015)
r2	0.088	0.140	0.155	0.151	0.085	0.141	0.156	0.154
N	6689	6689	6689	6560	7319	7319	7319	7226

Dependent variable: Self-rated health (5=very good, 1=very poor). Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05. All subjects are alive on December 31st in the interview year.

[a] People who died in period t+1 are removed in columns 4 and 8; hence, the lower N.

Table V: Economic gradient in survival probabilities using different health measures as controls, Linear probability model

	No Health	Self-rated Health	Hospital days			
			t	t-2 & t-1	t+1	t+2[b]
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A: MEN						
Wealth rank	0.080***	0.051***	0.071***	0.066***	0.062***	0.052***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)
Self-rated Health		0.199***				
		(0.028)				
Self-rated Health (sq.)		-0.020***				
		(0.004)				
Covariates[a]	Yes	Yes	Yes	Yes	Yes	Yes
Hospital days (t)	No	No	Yes	Yes	Yes	Yes
Hospital days (t-1 & t-2)	No	No	No	Yes	Yes	Yes
Hospital days (t+1)	No	No	No	No	Yes	Yes
Hospital days (t+2)	No	No	No	No	No	Yes
R^2	0.137	0.173	0.174	0.179	0.219	0.215
N	6687	6687	6687	6687	6687	6558
t-test value		2.253	0.740	1.084	1.469	2.329
one-sided p-value		0.012	0.230	0.139	0.071	0.010
PANEL B: WOMEN						
Wealth rank	0.075***	0.042***	0.065***	0.061***	0.058***	0.044***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.010)
Self-rated Health		0.193***				
		(0.025)				
Self-rated Health (sq.)		-0.021***				
		(0.003)				
Covariates[a]	Yes	Yes	Yes	Yes	Yes	Yes
Hospital days (t)	No	No	Yes	Yes	Yes	Yes
Hospital days (t-1 & t-2))	No	No	No	Yes	Yes	Yes
Hospital days (t+1)	No	No	No	No	Yes	Yes
Hospital days (t+2)	No	No	No	No	No	Yes
R^2	0.077	0.113	0.113	0.127	0.173	0.207
N	7319	7319	7319	7319	7319	7226
t-value		2.792	0.827	1.144	1.489	2.895
one-sided p-value		0.003	0.204	0.126	0.068	0.002

Dependent variable: Indicator of being alive 5 years after interview. The economic gradient in survival/mortality is captured by the variable "wealth rank" that measures the within year, gender and cohort rank of equivalized household financial and housing wealth. Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05. The row "t-value" is the result of testing the parameter estimate of "Wealth rank" in the given column different from that in column (1); the row "one-sided p-value" is the corresponding p-value of this one-sided test.

[a] Covariates include age, age squared, civil status and education (Low, intermediate and high).

[b] People who died in period t+1 are removed in column 6; hence, the lower N.

Table VI: (APPENDIX TABLE) Self-rated health vs. hospital days, Ordered probit

	Men				Women			
Successively adding:	t (1)	t-2 & t-1 (2)	t+1 (3)	t+2[a] (4)	t (5)	t-2 & t-1 (6)	t+1 (7)	t+2[a] (8)
Hospitalized (t-2)		-.209***	-.187***	-.176***		-.263***	-.242***	-.227***
		(.035)	(.035)	(.036)		(.036)	(.036)	(.036)
Hospitalized (t-1)		-.197***	-.171***	-.163***		-.208***	-.193***	-.185***
		(.036)	(.036)	(.036)		(.034)	(.034)	(.034)
Hospitalized (t)	-.323***	-.211***	-.178***	-.149***	-.376***	-.282***	-.246***	-.232***
	(.034)	(.035)	(.035)	(.035)	(.032)	(.032)	(.032)	(.032)
Hospitalized (t+1)			-.162***	-.109**			-.154***	-.122***
			(.035)	(.036)			(.032)	(.033)
Hospitalized (t+2)				-.176***				-.125***
				(.033)				(.032)
Hospital days (t-2)		-.012***	-.011***	-.011***		-.017***	-.015***	-.014***
		(2.4e-03)	(2.5e-03)	(2.6e-03)		(3.5e-03)	(3.5e-03)	(3.6e-03)
Hospital days sq. (t-2)		4.6e-05***	4.5e-05***	4.2e-05***		9.1e-05**	7.2e-05*	7.0e-05*
		(1.0e-05)	(1.1e-05)	(1.2e-05)		(3.5e-05)	(3.5e-05)	(3.4e-05)
Hospital days (t-1)		-.022***	-.02***	-.019***		-.015***	-.013***	-.013***
		(2.9e-03)	(2.8e-03)	(2.9e-03)		(3.4e-03)	(3.6e-03)	(3.6e-03)
Hospital days sq. (t-1)		1.2e-04***	1.1e-04***	1.0e-04***		7.5e-05	6.6e-05	5.6e-05
		(2.2e-05)	(2.1e-05)	(2.1e-05)		(3.9e-05)	(4.3e-05)	(4.4e-05)
Hospital days (t)	-.03***	-.025***	-.022***	-.021***	-.026***	-.022***	-.019***	-.018***
	(2.5e-03)	(2.6e-03)	(2.6e-03)	(2.5e-03)	(2.4e-03)	(2.3e-03)	(2.3e-03)	(2.3e-03)
Hospital days sq. (t)	7.9e-05***	7.3e-05***	6.8e-05***	6.4e-05***	7.1e-05***	6.4e-05***	6.0e-05***	5.4e-05***
	(7.3e-06)	(7.3e-06)	(7.8e-06)	(7.8e-06)	(1.3e-05)	(1.2e-05)	(1.1e-05)	(9.8e-06)
Hospital days (t+1)			-.012***	-.011***			-.016***	-.013***
			(2.5e-03)	(2.7e-03)			(2.4e-03)	(2.5e-03)
Hospital days sq. (t+1)			3.8e-05	3.6e-05			9.8e-05***	8.3e-05***
			(2.2e-05)	(2.4e-05)			(1.5e-05)	(1.4e-05)
Hospital days (t+2)				-4.9e-03*				-9.3e-03***
				(2.3e-03)				(2.1e-03)
Hospital days sq. (t+2)				2.2e-05				4.5e-05***
				(1.6e-05)				(1.0e-05)
cut1								
constant	-2.32***	-2.53***	-2.61***	-2.68***	-2.23***	-2.47***	-2.54***	-2.6***
	(.04)	(.043)	(.045)	(.047)	(.036)	(.04)	(.041)	(.043)
cut2								
constant	-1.67***	-1.85***	-1.92***	-1.98***	-1.58***	-1.78***	-1.84***	-1.89***
	(.026)	(.029)	(.03)	(.032)	(.024)	(.027)	(.028)	(.029)
cut3								
constant	-.743***	-.885***	-.937***	-.987***	-.603***	-.76***	-.811***	-.848***
	(.019)	(.021)	(.022)	(.023)	(.018)	(.02)	(.021)	(.022)
cut4								
constant	.331***	.221***	.179***	.143***	.423***	.298***	.256***	.226***
	(.018)	(.02)	(.02)	(.021)	(.017)	(.019)	(.02)	(.021)
r2								
N	6689	6689	6689	6560	7319	7319	7319	7226

Dependent variable: Self-rated health (5=very good, 1=very poor). Significanse levels ***<.001, **<.01, *<.05. t is the interview year. All subjects are alive on December 31st in the interview year.
[a] People who died in period t+1 are removed in columns 4 and 8; hence, the lower N.

Table VII: (APPENDIX TABLE) Economic gradient in survival probabilities using different health measures as controls, Linear probability model, Men.

	No Health	Self-rated Health	Hospital records			
			t	t-2 & t-1	t+1	t+2[a]
Wealth rank[a]	.080***	.051***	.071***	.066***	.062***	.052***
	(.013)	(.013)	(.013)	(.013)	(.013)	(.012)
Subjective Health ()		.199***				
		(.028)				
Self rated (sq.)		-.02***				
		(3.6e-03)				
Hospitalized (t-2)				-4.0e-03	5.4e-04	-1.8e-03
				(9.7e-03)	(9.7e-03)	(9.4e-03)
Hospitalized (t-1)				7.8e-04	7.8e-03	7.4e-03
				(1.0e-02)	(9.8e-03)	(9.3e-03)
Hospitalized (t)			-6.4e-03	-5.5e-04	6.0e-03	8.8e-03
			(9.7e-03)	(9.8e-03)	(9.7e-03)	(9.4e-03)
Hospitalized (t+1)					-.011	8.7e-03
					(9.8e-03)	(9.3e-03)
Hospitalized (t+2)						-8.9e-03
						(8.8e-03)
Hospital days (t-2)				-2.1e-03*	-1.7e-03	-1.0e-03
				(9.5e-04)	(1.0e-03)	(1.0e-03)
Hospital days sq. (t-2)				3.9e-06	2.6e-06	3.7e-07
				(3.4e-06)	(5.0e-06)	(5.4e-06)
Hospital days (t-1)				-2.6e-03*	-1.7e-03	-1.3e-03
				(1.0e-03)	(1.0e-03)	(1.0e-03)
Hospital days sq. (t-1)				1.4e-05**	9.9e-06	8.4e-06
				(5.4e-06)	(5.3e-06)	(5.3e-06)
Hospital days (t)			-8.7e-03***	-8.1e-03***	-6.1e-03***	-4.6e-03***
			(9.5e-04)	(9.7e-04)	(9.8e-04)	(1.1e-03)
Hospital days sq. (t)			2.4e-05***	2.3e-05***	2.0e-05***	1.4e-05***
			(4.0e-06)	(4.0e-06)	(3.8e-06)	(4.2e-06)
Hospital days (t+1)					-8.5e-03***	-4.9e-03***
					(1.1e-03)	(1.1e-03)
Hospital days sq. (t+1)					3.0e-05**	1.7e-05
					(9.5e-06)	(9.8e-06)
Hospital days (t+2)						-7.4e-03***
						(1.1e-03)
Hospital days sq. (t+2)						2.4e-05**
						(8.7e-06)
Single	-.059***	-.047***	-.054***	-.052***	-.045***	-.035***
	(.011)	(.011)	(.011)	(.011)	(.011)	(.010)
Intermediate education	-2.6e-03	-.013	-3.3e-03	-2.9e-03	1.8e-05	-4.4e-04
	(9.5e-03)	(9.4e-03)	(9.3e-03)	(9.3e-03)	(9.1e-03)	(8.6e-03)
High education	.013	-7.2e-03	8.3e-03	8.9e-03	9.7e-03	.012
	(.011)	(.011)	(.011)	(.011)	(.01)	(9.7e-03)
Age	.063***	.061***	.062***	.061***	.062***	.061***
	(7.4e-03)	(7.2e-03)	(7.2e-03)	(7.2e-03)	(7.1e-03)	(6.9e-03)
Age squared	-5.7e-04***	-5.5e-04***	-5.6e-04***	-5.5e-04***	-5.5e-04***	-5.4e-04***
	(5.9e-05)	(5.8e-05)	(5.8e-05)	(5.8e-05)	(5.6e-05)	(5.5e-05)
constant	-.785***	-1.18***	-.75***	-.74***	-.764***	-.781***
	(.228)	(.225)	(.224)	(.223)	(.218)	(.213)
R^2	0.137	0.173	0.174	0.179	0.219	0.215
N	6687	6687	6687	6687	6687	6558
t-test		2.253	0.740	1.084	1.469	2.329
one-sided p value		0.012	0.230	0.139	0.071	0.010

Dependent variable: Indicator of being alive 5 years after interview. The economic gradient in survival/mortality is captured by the variable "wealth rank" that measures the within year, gender and cohort rank of equivalized household financial and housing wealth. Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05.

[a] People who died in period t+1 are removed in column 6; hence, the lower N.

Table VIII: (APPENDIX TABLE) Economic gradient in survival probabilities using different health measures as controls, Linear probability model, Women.

	No Health	Self-rated Health	Hospital records			
			t	t-2 & t-1	t+1	t+2[a]
Wealth rank[a]	.075***	.042***	.065***	.061***	.058***	.044***
	(.012)	(.012)	(.012)	(.012)	(.011)	(.010)
Subjective Health ()		.193***				
		(.025)				
Self rated (sq.)		-.021***				
		(3.3e-03)				
Hospitalized (t-2)				-3.7e-03	1.8e-03	-7.0e-03
				(9.1e-03)	(8.9e-03)	(8.2e-03)
Hospitalized (t-1)				6.1e-03	7.3e-03	7.4e-03
				(8.8e-03)	(8.7e-03)	(8.0e-03)
Hospitalized (t)			-9.3e-03	-1.6e-03	7.8e-03	9.5e-03
			(8.6e-03)	(8.6e-03)	(8.4e-03)	(7.7e-03)
Hospitalized (t+1)					1.6e-03	9.2e-03
					(8.5e-03)	(8.0e-03)
Hospitalized (t+2)						.013
						(7.7e-03)
Hospital days (t-2)				-3.6e-03**	-2.4e-03*	7.7e-05
				(1.2e-03)	(1.2e-03)	(1.1e-03)
Hospital days sq. (t-2)				4.4e-06	-5.2e-06	-2.1e-05*
				(1.2e-05)	(1.1e-05)	(1.0e-05)
Hospital days (t-1)				-4.0e-03***	-3.3e-03**	-2.7e-03*
				(1.2e-03)	(1.1e-03)	(1.1e-03)
Hospital days sq. (t-1)				3.1e-05***	2.8e-05***	2.6e-05**
				(8.4e-06)	(7.9e-06)	(8.5e-06)
Hospital days (t)			-7.1e-03***	-6.4e-03***	-5.0e-03***	-3.2e-03***
			(9.3e-04)	(9.2e-04)	(9.2e-04)	(8.4e-04)
Hospital days sq. (t)			1.6e-05***	1.4e-05***	1.3e-05***	5.4e-06*
			(3.6e-06)	(3.5e-06)	(3.3e-06)	(2.6e-06)
Hospital days (t+1)					-.01***	-5.6e-03***
					(1.1e-03)	(1.1e-03)
Hospital days sq. (t+1)					4.8e-05***	2.4e-05**
					(8.6e-06)	(8.9e-06)
Hospital days (t+2)						-.011***
						(9.2e-04)
Hospital days sq. (t+2)						4.2e-05***
						(6.4e-06)
Single	-.021**	-.015	-.017*	-.014	-.011	-5.6e-03
	(8.0e-03)	(7.8e-03)	(7.9e-03)	(7.8e-03)	(7.6e-03)	(7.0e-03)
Intermediate education	.024***	.017*	.026***	.026***	.024***	.020**
	(7.3e-03)	(7.2e-03)	(7.2e-03)	(7.1e-03)	(6.9e-03)	(6.4e-03)
High education	.014	2.6e-03	.015	.016	.016	.014
	(9.3e-03)	(9.2e-03)	(9.2e-03)	(9.1e-03)	(8.7e-03)	(8.1e-03)
Age	.030***	.028***	.028***	.026***	.024***	.023***
	(6.0e-03)	(5.9e-03)	(5.9e-03)	(5.9e-03)	(5.7e-03)	(5.5e-03)
Age squared	-2.8e-04***	-2.7e-04***	-2.6e-04***	-2.5e-04***	-2.2e-04***	-2.1e-04***
	(4.7e-05)	(4.7e-05)	(4.7e-05)	(4.6e-05)	(4.6e-05)	(4.4e-05)
constant	.138	-.227	.202	.238	.307	.340*
	(.187)	(.186)	(.184)	(.183)	(.179)	(.17)
R^2	0.077	0.113	0.113	0.127	0.173	0.207
N	7319	7319	7319	7319	7319	7226
t-test		2.792	0.827	1.144	1.489	2.896
one-sided p value		0.003	0.204	0.126	0.068	0.002

Dependent variable: Indicator of being alive 5 years after interview. The economic gradient in survival/mortality is captured by the variable "wealth rank" that measures the within year, gender and cohort rank of equivalized household financial and housing wealth. Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05.
[a] People who died in period t+1 are removed in column 6; hence, the lower N.

Table IX: (APPENDIX TABLE) Economic gradient in survival probabilities using different health measures as controls, Probit model, Men.

	No Health	Self-rated Health	Hospital records			
			t	t-2 & t-1	t+1	t+2[a]
Wealth rank[a]	.510***	.350***	.476***	.452***	.444***	.431***
	(.081)	(.083)	(.083)	(.084)	(.086)	(.092)
Subjective Health ()		.57***				
		(.115)				
Self rated (sq.)		-.037*				
		(.017)				
Hospitalized (t-2)				-.037	-.028	-.048
				(.056)	(.058)	(.063)
Hospitalized (t-1)				-.029	.018	.022
				(.059)	(.061)	(.067)
Hospitalized (t)			-.123*	-.079	-.028	-4.6e-03
			(.054)	(.056)	(.059)	(.063)
Hospitalized (t+1)					-.139*	.025
					(.057)	(.062)
Hospitalized (t+2)						-.173**
						(.059)
Hospital days (t-2)				-8.6e-03*	-4.9e-03	-1.6e-03
				(3.4e-03)	(3.9e-03)	(4.3e-03)
Hospital days sq. (t-2)				1.7e-05	-8.5e-06	-2.4e-05
				(1.3e-05)	(2.1e-05)	(2.2e-05)
Hospital days (t-1)				-9.8e-03*	-7.0e-03	-5.8e-03
				(4.4e-03)	(4.7e-03)	(5.8e-03)
Hospital days sq. (t-1)				6.3e-05	4.8e-05	4.2e-05
				(3.6e-05)	(3.9e-05)	(6.4e-05)
Hospital days (t)			-.029***	-.027***	-.021***	-.017***
			(3.3e-03)	(3.4e-03)	(3.5e-03)	(3.8e-03)
Hospital days sq. (t)			7.8e-05***	7.5e-05***	6.7e-05***	5.0e-05***
			(1.3e-05)	(1.2e-05)	(1.3e-05)	(1.4e-05)
Hospital days (t+1)					-.031***	-.021***
					(3.6e-03)	(3.9e-03)
Hospital days sq. (t+1)					1.3e-04***	9.7e-05**
					(2.9e-05)	(3.1e-05)
Hospital days (t+2)						-.026***
						(3.3e-03)
Hospital days sq. (t+2)						8.6e-05***
						(2.4e-05)
Single	-.305***	-.265***	-.293***	-.286***	-.259***	-.238***
	(.052)	(.053)	(.053)	(.054)	(.055)	(.059)
Intermediate education	-.015	-.072	-.014	-9.1e-03	.012	3.6e-03
	(.051)	(.053)	(.052)	(.052)	(.053)	(.057)
High education	.119	.012	.105	.113	.122	.169*
	(.074)	(.077)	(.075)	(.076)	(.078)	(.086)
Age	.082*	.075	.087*	.084*	.096*	.13**
	(.039)	(.04)	(.039)	(.04)	(.041)	(.043)
Age squared	-1.1e-03***	-1.0e-03***	-1.1e-03***	-1.1e-03***	-1.1e-03***	-1.4e-03***
	(2.9e-04)	(3.0e-04)	(3.0e-04)	(3.0e-04)	(3.1e-04)	(3.2e-04)
constant	.336	-.962	.222	.347	.027	-1.02
	(1.27)	(1.33)	(1.3)	(1.31)	(1.35)	(1.43)
R^2						
N	6687	6687	6687	6687	6687	6558

Dependent variable: Indicator of being alive 5 years after interview. The economic gradient in survival/mortality is captured by the variable "wealth rank" that measures the within year, gender and cohort rank of equivalized household financial and housing wealth. Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05.
[a] People who died in period t+1 are removed in column 6; hence, the lower N.

Table X: (APPENDIX TABLE) Economic gradient in survival probabilities using different health measures as controls, Probit model, Women.

	No Health	Self-rated Health	Hospital records			
			t	t-2 & t-1	t+1	t+2[a]
Wealth rank[a]	.497***	.29***	.449***	.429***	.435***	.392***
	(.084)	(.088)	(.087)	(.087)	(.090)	(.096)
Subjective Health ()		.616***				
		(.107)				
Self rated (sq.)		-.048**				
		(.016)				
Hospitalized (t-2)				-.05	-6.5e-03	-.050
				(.06)	(.062)	(.067)
Hospitalized (t-1)				.015	.026	.053
				(.061)	(.063)	(.07)
Hospitalized (t)			-.156**	-.099	-.021	.028
			(.054)	(.055)	(.058)	(.065)
Hospitalized (t+1)					-.134*	-.03
					(.057)	(.063)
Hospitalized (t+2)						-.057
						(.064)
Hospital days (t-2)				-.015**	-.011*	-1.0e-03
				(4.7e-03)	(4.9e-03)	(5.6e-03)
Hospital days sq. (t-2)				4.8e-05	1.3e-05	-5.7e-05
				(4.2e-05)	(4.4e-05)	(4.8e-05)
Hospital days (t-1)				-.022***	-.018**	-.021**
				(6.2e-03)	(6.2e-03)	(6.8e-03)
Hospital days sq. (t-1)				2.0e-04*	1.7e-04*	2.3e-04**
				(8.0e-05)	(8.2e-05)	(8.6e-05)
Hospital days (t)			-.026***	-.023***	-.018***	-.013**
			(3.1e-03)	(3.1e-03)	(3.3e-03)	(4.4e-03)
Hospital days sq. (t)			6.2e-05***	5.5e-05***	5.2e-05***	1.2e-05
			(1.3e-05)	(1.3e-05)	(1.3e-05)	(3.4e-05)
Hospital days (t+1)					-.034***	-.021***
					(3.7e-03)	(4.0e-03)
Hospital days sq. (t+1)					1.7e-04***	1.0e-04***
					(3.1e-05)	(2.8e-05)
Hospital days (t+2)						-.044***
						(4.3e-03)
Hospital days sq. (t+2)						2.3e-04***
						(4.0e-05)
Single	-.129**	-.095	-.106*	-.091	-.082	-.044
	(.049)	(.05)	(.05)	(.051)	(.052)	(.056)
Intermediate education	.166***	.141**	.195***	.203***	.191***	.175**
	(.05)	(.051)	(.051)	(.051)	(.053)	(.057)
High education	.104	.023	.117	.133	.147	.13
	(.076)	(.078)	(.077)	(.078)	(.08)	(.089)
Age	-1.4e-03	-6.3e-03	-7.2e-03	-8.7e-03	-.016	-4.8e-03
	(.037)	(.038)	(.038)	(.038)	(.039)	(.042)
Age squared	-3.2e-04	-2.7e-04	-2.6e-04	-2.4e-04	-1.7e-04	-2.5e-04
	(2.8e-04)	(2.9e-04)	(2.8e-04)	(2.9e-04)	(2.9e-04)	(3.1e-04)
constant	2.62*	1.31	2.9*	2.96*	3.23*	2.99*
	(1.24)	(1.27)	(1.26)	(1.27)	(1.29)	(1.39)
R^2						
N	7319	7319	7319	7319	7319	7226

Dependent variable: Indicator of being alive 5 years after interview. The economic gradient in survival/mortality is captured by the variable "wealth rank" that measures the within year, gender and cohort rank of equivalized household financial and housing wealth. Robust Standard Errors in parentheses. Significance levels ***<.001, **<.01, *<.05.

[a] People who died in period t+1 are removed in column 6; hence, the lower N.